ASSESSMENT OF EMISSIONS FROM A CHAIN-DRIVEN CHARBROILER (NIECO MODEL 9025, GOLDEN WEST EQUIPMENT, INC.) USING A CATALYTIC CONTROL DEVICE (MODEL 7-193)

Final Report

for:

ENGELHARD CORPORATION

September 13, 2002

__Prepared by:__

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Principal Development Engineer

Report No: 02-AP-145D-904050476-01-FR

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Background

The University of California, Riverside College of Engineering - Center for Environmental Research and Technology (CE-CERT) has conducted the following emissions testing and analyses:

Report No: 02-AP-145D-904050476-01-FR

For: Golden West Equipment, Inc.
Contact: Mike Kennedy (800) 404-9040
Engelhard Corporation
Contact: Chuck Patellis (440) 548-5866

Principal Investigator: William A. Welch

Purpose: To assess particulate matter and volatile organic compound emissions from a chain-driven charbroiler using a catalytic incineration control device manufactured by Engelhard Corporation.

Tested At: CE-CERT
University of California, Riverside

Test Dates: June 6 – 7, 2002

Final Draft Report: August 23, 2002

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Project Staff:

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EXECUTIVE SUMMARY

The South Coast Air Quality Management District (SCAQMD) has promulgated new regulations affecting emissions of particulate matter (PM) and volatile organic gas (VOC) emissions from restaurants operating in the South Coast Air Basin through development and implementation of Proposed Rule 1138. As part of the rule development process, the SCAQMD has developed and demonstrated standardized facilities and procedures for certifying cooking and control equipment in lieu of source testing at actual field sites. Under previously funded programs, testing was conducted to determine the accuracy and reproducibility of the process, sampling, and analytical aspects of operating the standardized facility. Once established, the standardized procedures were used to develop emission factors from a variety of commercial cooking operations and to determine the emissions reduction efficiencies for several control technologies.

Under a purchase agreement with Engelhard Corporation, the University of California, Riverside Bourns College of Engineering - Center for Environmental Research and Technology (CE-CERT) has utilized the standardized test chamber, facilities, and procedures to assess the PM and VOC emissions from a chain-driven charbroiler cooking process using a catalytic incineration device developed by Engelhard Corporation.

The results documented in this report include process parameters (food product specifications, cooking temperatures, ventilation flow rates, etc.), PM and VOC emission factors, emission reduction efficiencies, and flow rate data.

1.0 INTRODUCTION

Three previous studies conducted at the Bourns College of Engineering - Center for Environmental Research and Technology (CE-CERT) under contract with the South Coast Air Quality Management District (SCAQMD) have included development of standardized procedures, demonstration of the validity of those procedures for evaluating emissions from commercial cooking operations, and the development of emission factors from various cooking processes.[1,2,3]

The initial programs involved the investigation of several methods for determination of pollutant emissions, including particulate matter with an aerodynamic diameter less than 10 microns by cascade impaction, volatile organic compound (VOC) emissions from a modified reference method, and total gaseous hydrocarbons using a continuous flame ionization detector (FID). During the course of the program, CE-CERT investigated differences found between FID and reference (SCAQMD M25.1) VOC measurements. The differences included irregularities between duplicate measurements and repeatability between runs. The performance of both methods was challenged by conducting several diagnostic test runs. The diagnostic tests included triplicate testing and performance evaluations with audit gases.

During the third project, CE-CERT refined methods for sampling and analysis of VOC and particulate matter PM emissions from commercial cooking operations. PM emissions were determined using a modified SCAQMD Method 5.1, which includes PM captured on a filter as well as condensed PM captured in impinger solutions; and a Micro-Orifice Uniform Deposit Impactor (MOUDI™) system that separates particles by aerodynamic diameter using a cascade impactor train. VOC emissions were quantified using a continuous flame ionization detector (FID) to measure total gaseous hydrocarbons and methane in a conditioned sample stream. A separate sample was drawn from the gaseous stream to determine the fraction of effluent containing oxygenated organic compounds. If the species, concentration, and FID response factors for oxygenated compounds are known, an overall weighted average response factor can be applied to the average FID-measured concentration to obtain the a more accurate measure of total hydrocarbon concentration. CE-CERT verified that this VOC emissions measurement method was more consistent and precise than the accepted reference method. CE-CERT used the refined procedures to determine emission factors for eleven uncontrolled cooking processes and three processes with emission control technology.

Under the current purchase agreement with Engelhard Corporation, CE-CERT used the standardized test chamber and cooking processes to evaluated the emissions from cooking hamburgers on a Nieco Model 9025 chain-driven charbroiler, fitted with an 18” x 24” catalytic incineration unit (Model 7-193) designed and developed by Engelhard. Results were evaluated with regard to emission reduction efficiencies of the Engelhard-equipped process compared with previous results using the uncontrolled chain-driven charbroiler.

Three identical test runs were conducted with the Engelhard process. A pre-determined sequence and loading rate for the hamburger patties was used during each of the three test runs. During each run, integrated PM and continuous VOC samples were extracted concurrently.

This report details the findings from the series of tests conducted in CE-CERT's stationary source emissions test chamber, including the process and environmental conditions under which the tests were performed, the sampling and analytical procedures used, and the resultant emissions data.

2.0 TEST CHAMBER AND EQUIPMENT SPECIFICATIONS

A test chamber equipped with natural gas, electricity, ventilation and fire suppression utilities was used to conduct the testing program. A schematic of the chamber is shown in Figure 1. The dimensions of the chamber are 25 x 25 x 10 feet. Natural gas is provided inside the chamber through 1 1/4" pipe at 5 psig. 115 V single phase, 230 V single phase, 230 V three phase, and 480 V three phase electrical utilities are available inside the chamber. Exhaust ventilation is provided by a hood that is ducted to a centrifugal-type upblast blower located on the roof of the chamber. Make-up air is supplied by an evaporative cooler and blower through four penetrations and eight diffuser panels in the test chamber ceiling. Access to the sampling locations is provided by a stairway on the west end of the chamber.

The cooking device used during the test program was a Nieco Model 9025 conveyorized charbroiler, fired with natural gas. The natural gas flow rate was measured with a calibrated dry gas meter. The heating value of the gas was measured with a Cutler-Hammer calorimeter. The unit provides flame broiling on both sides of food products in two separate chambers as they pass through sets of chain conveyors. A ventilation shroud (covering both broiling chambers) and catalyst support structure was fitted to the top of the cooking device.

Emissions generated during the cooking process were captured by a 4 x 4-foot Captive-Aire stainless steel wall canopy hood. Emissions captured by the hood were ducted horizontally across the roof of the test chamber to the upblast blower. The exhaust blower, equipped with a variable speed drive and controller, was adjusted to ensure velocity and flow rate parameters met Uniform Mechanical Code (UMC) and National Fire Protection Association (NFPA) guidelines regarding exhaust velocities and flow rates. Emissions samples were drawn from the horizontal section of the duct through access ports. The cooking and ventilation equipment configuration is shown in Figure 2.

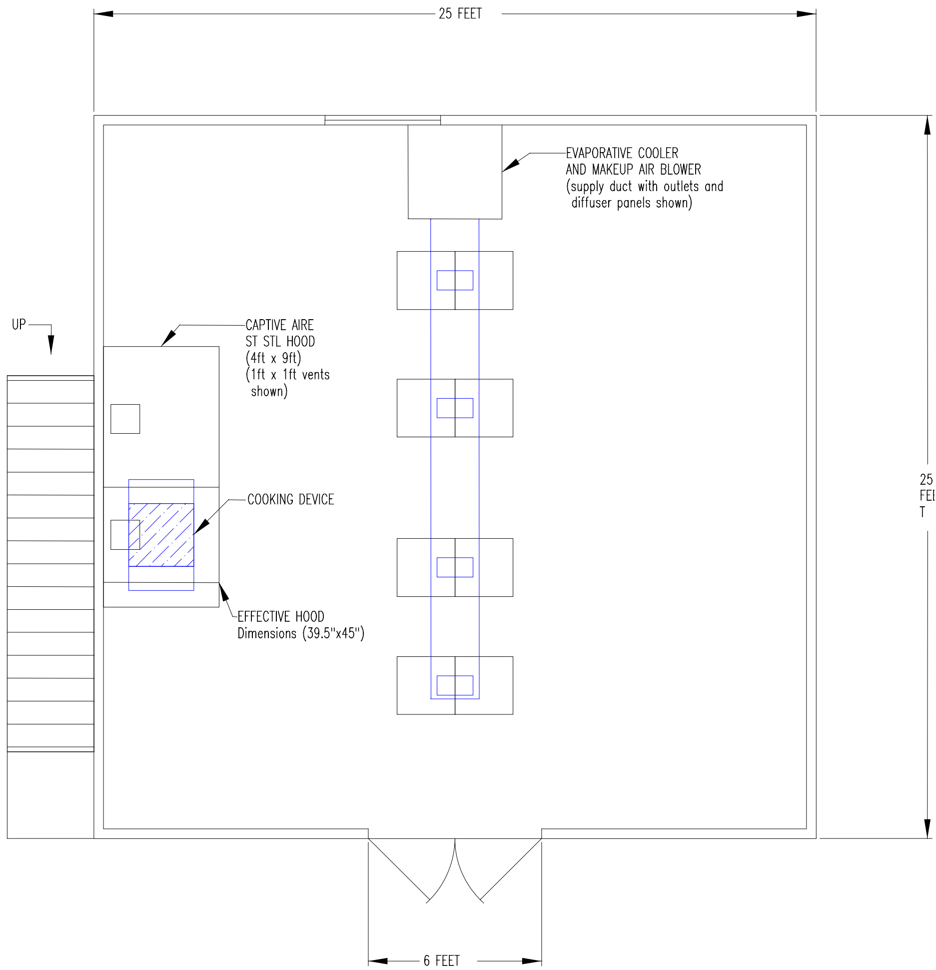

Figure 1
Test Chamber Schematic

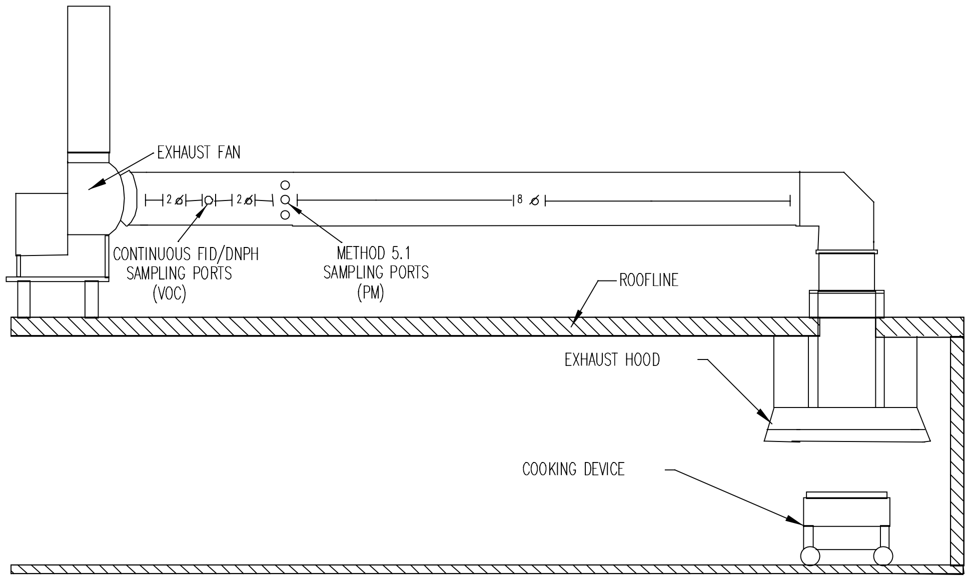

Figure 2
Cooking Equipment and Ventilation Configuration

3.0 SAMPLING AND ANALYTICAL PROCEDURES

3.1 Particulate Matter Method

For determination of total PM, the exhaust stream was sampled isokinetically following SCAQMD Method 5.1. An integrated sample for each test was acquired over a minimum of 72 minutes. Each sample was extracted from the exhaust duct through a stainless steel nozzle and probe, impingers immersed in an ice bath, and a tared 0.45 micron Gelman quartz fiber filter located downstream of the last impinger. An additional straight tube impinger (empty bubbler) was placed at the front of each sampling train (see Figure 4). The sample train was analyzed according to a modified SCAQMD Method 5.1. After sampling, the filter was removed and placed in a dessicator until completely dry. Following drying, the filter was weighed to determine the fraction of sample acquired on the filter. The probe, nozzle, sampling lines, and impingers were washed with deionized water and methylene chloride, and the washing solutions were combined with the impinger solutions. The combined solution was extracted with methylene chloride. The aqueous fraction was heated to boil off water, and the organic fraction was allowed to evaporate at room temperature. Residues from both fractions were weighed and combined with the sample weight from the filter to determine the total particulate sample weight. Samples not analyzed within a 48-hour period after acquisition were stored at 4 ^oC until analyses.

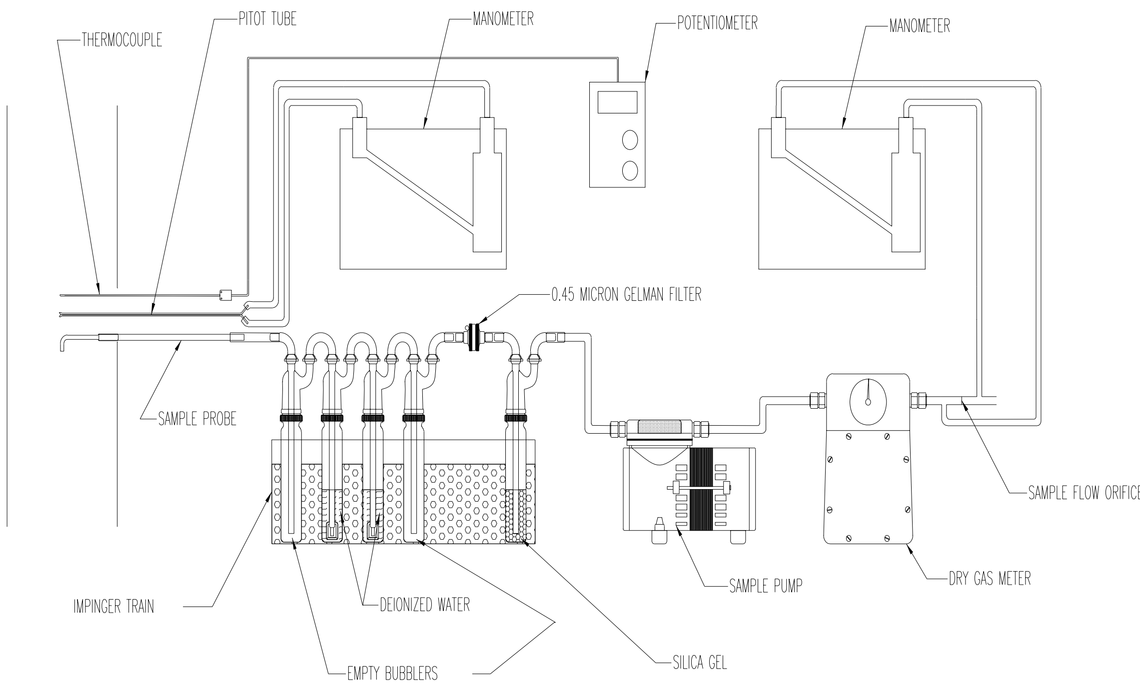

Figure 3
Particulate Matter Sampling System

3.2 Volatile Organic Compound Method (Continuous FID/Oxygenates)

Sampling was conducted according to procedures developed by CE-CERT and documented in a report titled "Further Development of Emission Test Methods and Development of Emission Factors for Various Commercial Cooking Operations - Final Report," issued in August, 1997.

A continuous sample was extracted from the exhaust stream through the sample conditioning system shown in Figure 5 during each test run. The conditioning system consisted of a SCAQMD Method 5.1 sampling train, including a single in-stack nozzle (facing downstream), a stainless steel probe, impingers (the 2 middle impingers of 4 containing 100 ml of deionized water) in an ice bath, and a 0.45 micron pore size Gelman paper filter. The sample stream was drawn through the conditioning system and manifold to an analyzer using a flame ionization detector (FID). The FID analyzer continuously measured the total gaseous hydrocarbon concentration (as CH_4). Methane was determined with a single-channel FID fitted with an activated carbon filter (used to remove all gaseous hydrocarbons except methane). An integrated sample was acquired in a Tedlar bag at the end of each test run over a minimum of 15 minutes and immediately analyzed with the FID/activated carbon filter system.

The FID analyzer was zeroed with pure nitrogen and calibrated with a known (NIST traceable) concentration of a gaseous hydrocarbon mixture (methane, ethane, and isobutane) prior to each test. The calibration procedure included a 3-point check for linearity and determination of system bias. The analyzer was operated for the entire duration of each test. A post-test calibration check was performed with the zero nitrogen and span gas following each sampling period.

A second sample was drawn from the manifold through a series of three cartridges containing crystalline 2,4-dinitrophenylhydrazine (DNPH) impregnated on a C-18 sorbent.

The sample flow rate was set to approximately 1 liter per minute and measured with a calibrated dry gas meter. The DNPH cartridges were extracted with acetonitrile and analyzed for aldehyde and ketone derivatives using high performance liquid chromatography (HPLC). A comparison of concentrations of each species in the three cartridges was performed to determine the extent of breakthrough. Mass emissions of individual carbonyl species were determined from analyzed concentrations, sample volume, and effluent volumetric flow rate. These data were used to determine a weighted average FID response, using published FID response factors.[4]

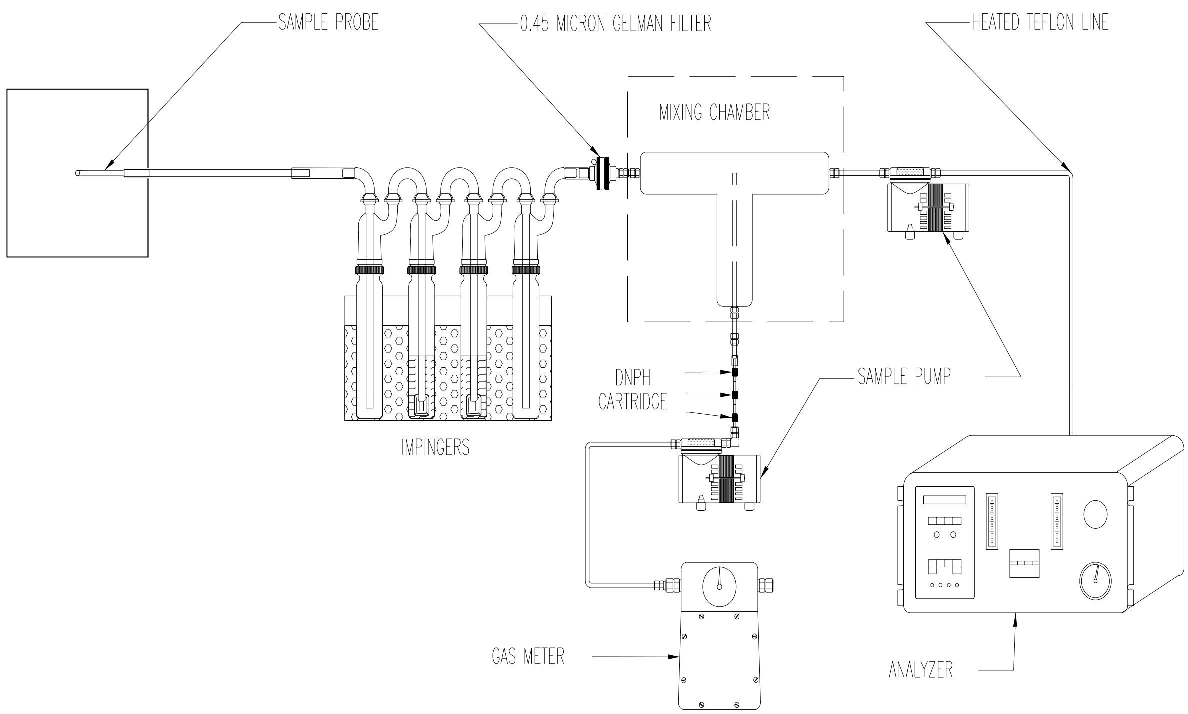

Figure 4
VOC Sampling System

3.3 Fixed Gases, Moisture, and Flow Determination

Carbon monoxide and carbon dioxide concentrations were continuously monitored and recorded using a non-dispersive infrared detector. The sampling, conditioning, and analyses of CO and CO_2 followed SCAQMD Method 100.1. Flow rate in the exhaust duct was determined using differential pressure and temperature measurements according to SCAQMD Methods 1, 2 and 3. Moisture content in the effluent was determined gravimetrically using SCAQMD Method 4.

4.0 PROCESS DESCRIPTION

The cooking device used for testing was a Nieco Model 9025 conveyorized charbroiler, fired with natural gas. The natural gas flow rate was measured with a calibrated dry gas meter. The heating value of the gas was measured with a Cutler-Hammer calorimeter. The firing rate was set to operate within 5% of the manufacturer’s specified input rate. In addition, the gas supply pressure was within +/- 2.5% of the manufacturer’s specified operating pressure. The broiler controls, including the conveyor speed and thermostat, were set according to the manufacturer’s specifications. The Engelhard Model 7-193 catalytic control device and ventilation shroud (designed to direct the flow of the two chambers exhaust through the catalyst) was installed on top of the automated broiler. The device tested used the heat generated by the broiler to achieve operating temperature, and required no external utility. The Engelhard control unit consisted of a stainless steel support structure/transition piece (approximately 18" x 24") that contained a corrugated steel substrate coated with a precious metal catalyst.

4.1 Process Conditions

Prior to testing, the hamburger patties were prepared by loading them onto sheet pans lined with freezer paper. The ¼ pound meat patties specified were finished grind, pure beef hamburger, 21% fat by weight, 58-62% moisture, 3/8" thick, and 5" in diameter. The fat and moisture content of the patties were verified in accordance with recognized laboratory procedures (AOAC Official Actions 960.39 and 950.46, respectively). One patty from the batch designated for each run was reserved for these analyses. Each pan was loaded with 16 patties. The pans were stacked in a freezer with spacers between each pan to provide for airflow. The internal freezer temperature was maintained at approximately -5 °F. This temperature was continuously monitored with a thermocouple placed in the freezer to ensure the pre-cooked condition of the meat.

The underfired broiler controls were set and the broiler was allowed to warm up for a minimum of one hour. The grill was loaded at 2/3 capacity. Therefore, 2 patties were sequentially loaded on the main broiler grate every 30 seconds, and 1 patty was loaded on the "flex" grate every minute, corresponding to an input of 75 lbs./hr.

Patties were cooked to an internal temperature of 165 °F, to confirm a medium-well condition. Internal meat temperature was determined with a stack of hamburger patties placed in a temperature measurement system. The system consisted of an insulated container with a thermocouple bundle attached to the lid (see Figure 5). The five thermocouples were placed in different locations and depths in order to minimize the variability of the measurement.

For the hamburger patties specified in this section, an internal meat temperature of 165 °F corresponds to a weight loss of approximately 34%. This correlation was confirmed using a minimum of three data points. The data points bracketed the target 165 °F meat temperature.

Once this correlation was confirmed, the percent weight loss was used to verify the "doneness" of the cooked patties. Using tongs, the patties were spread on a drip rack. After one minute, the patties were turned. After another minute the patties were transferred to a clean pan for weighing. If the average weight loss was not 35% +/- 2%, the total cooking time was adjusted (through adjustment of the conveyor speed) to attain 35% +/- 2% weight loss.

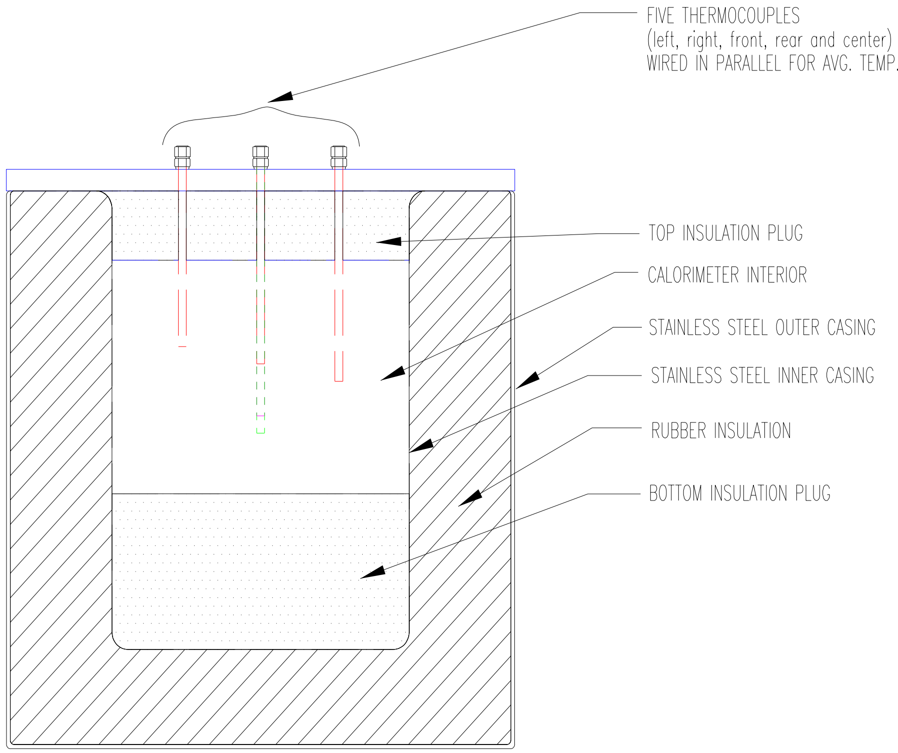

Figure 5

Internal Meat Temperature Measurement System

One patty from each run was reserved for moisture content analyses. These patties were placed in a freezer inside self-sealing plastic bags unless the moisture content test was conducted immediately. The moisture content of the cooked patties was determined in accordance with recognized laboratory procedures (AOAC Official Action 950.46). The moisture loss during cooking was calculated based on the initial moisture content of the patties.

Clean grease baffles were installed in the hood prior to testing. The velocity in the duct was set at 1600 fpm (with the charbroiler on). This velocity corresponded to a hood flow rate of 400 cfm for each linear foot of hood length. Testing was conducted for a minimum of 72 minutes.

5.0 RESULTS

Three identical test runs were performed using the process described in Section 4.0. The product loading rate, product quality indicator, PM and VOC emission factor results were calculated from the data collected during each run.

Table I summarizes the process and emission factor results for the three test runs. The average PM emission factor was 1.29 lbs. per 1000 lbs. of meat cooked. The average VOC emission factor was 0.19 lbs. per 1000 lbs. of meat cooked.

Table I
Process and Emissions Results
Automated Charbroiler/Engelhard Catalytic Control Device

Test #	Loading (lb/hr)	Product Temp (^oF)	% Weight Loss	% Fat Content	PM (lb/1000 lb)	VOC (lb/1000 lb)
020606-1	75.05	162.5	26.5	19.21	1.52	0.22
020607-1	74.98	165.7	30.4	20.26	1.19	0.16
020607-2	75.16	160.6	28.8	18.82	1.16	0.19
AVERAGE	75.06	162.9	28.6	19.43	1.29	0.19
SD	0.09	2.6	2.0	0.74	0.20	0.03

6.0 CONCLUSIONS

Results from the previous commercial cooking emissions study conducted at CE-CERT indicate that measurement and control of process parameters in a laboratory setting can dramatically improve the consistency and repeatability of results compared with those obtained from field testing.[1,2,3,5,6,7] By controlling cooking and ventilation parameters within specified limits, CE-CERT was able to obtain consistent and repeatable results.[3] Furthermore, the protocols developed during the previous study were successfully applied to the cooking processes studied in this test program.

Emissions reductions were successfully demonstrated for the dual-chamber chain-driven charbroiler process fitted with the Engelhard catalytic control device. The following Figure illustrates a comparison of PM and VOC emission factors between the Engelhard process and the uncontrolled process demonstrated in a separate program.[8]

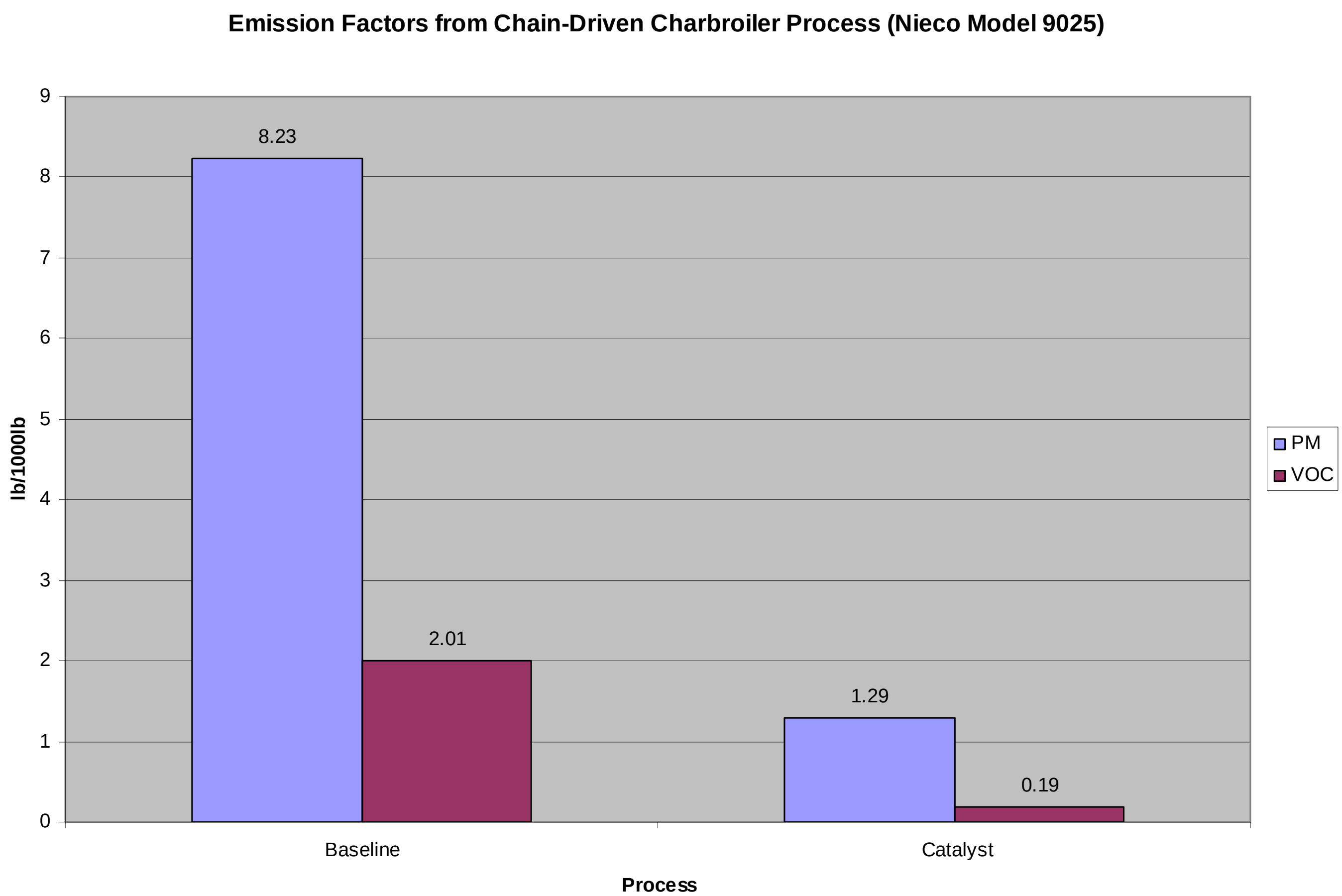

Figure 6

Emission factor Comparison

For PM, the Engelhard process demonstrated a control efficiency of 84.3%. For VOC, the unit demonstrated a control efficiency of 90.5%. The overall control efficiency for the process tested was 87.4%. Other catalytic control technologies demonstrated at CE-CERT for chain-driven charbroiling processes showed PM reduction efficiencies of 79%-86%, and VOC reduction efficiencies of 76%-96%.[3] Although the VOC reduction efficiency for the Engelhard catalyst is 90.5%, the baseline VOC emission factor for the dual-chamber broiler is 50% lower than the baseline factor for the previously tested chain driven charbroiler (1.12 vs. 2.27 lbs. VOC/1000 lbs. of meat cooked).

The correction of total hydrocarbon readings due to low response factors for oxygenated compounds averaged 15%, and were based on individual species and concentrations determined from HPLC analyses.

7.0 REFERENCES

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7. Gerstler, W.D., T.H. Kuehn, D.Y.H. Pui, J.W. Ramsey and M.P. Doerr, *Identification and Characterization of Effluents from Various Cooling Appliances and Processes as Related to Optimum Design of Kitchen Ventilation Systems, Final Report, ASHRAE 745-RP, Phase I*. Department of Mechanical Engineering, University of Minnesota, 1996.

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APPENDIX A

Source Test Data and Calculations

UNIVERSITY OF CALIFORNIA, RIVERSIDE
CE-CERT

Test No. :	020606-1	Test Date :	06/06/2002
Sampling Location :	On roof of chamber		
Sampling Train :	Mod. PM5.1 TR#2A	Input by :	Bill Welch

SOURCE TEST CALCULATIONS (VELOCITY)

Pre-test Velocity Leak Check:	OK	Post-Test Velocity Leak Check:	OK
Stack Diameter:	12.0 in	Gas Meter Correction Factor:	0.9843
Nozzle Diameter:	0.2499 in	Pitot Factor:	0.840
Nozzle Cross Area:	0.000341 ft^2	K Factor:	0.5555
Barometric Pressure:	28.9 in-Hg	% of Moisture:	2.00
Static Pressure in Stack:	-0.8 in-water	Sampling Time:	72 min

Time (min)	Traverse Point	Gas Meter Reading	Vel. Head (" water)	Temp. (°F)	Calc. Vel (fps)	Sampling Rate (cfm)	Theo. Orif P (" water)	Act. Orif P (" water)	Meter Temp. In (°F)	Meter Temp. Out (°F)
		348.086								
6	1	351.7	0.32	143	40.28	0.583	1.22	1.30	87	86
12	2	355.2	0.32	146	40.38	0.582	1.22	1.22	89	87
18	3	358.6	0.32	139	40.15	0.585	1.24	1.16	92	88
24	4	362.094	0.30	135	38.75	0.569	1.17	1.23	93	88
30	5	366.3	0.48	135	49.01	0.719	1.86	1.77	91	86
36	6	370.4	0.45	134	47.41	0.697	1.76	1.70	93	88
42	7	374.6	0.43	133	46.31	0.682	1.70	1.80	96	90
48	8	378.422	0.37	132	42.92	0.633	1.47	1.49	97	91
54	9	382.1	0.39	136	44.21	0.648	1.55	1.38	97	92
60	10	385.9	0.39	138	44.29	0.647	1.54	1.48	97	92
66	11	389.7	0.37	135	43.03	0.631	1.47	1.48	98	93
72	12	393.212	0.29	133	38.03	0.560	1.16	1.27	98	93
Net Volume		45.126								
Average			0.369	136.583	42.898	0.628	1.448	1.441	94.000	89.500
								Average	91.8 °F	

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CE-CERT

Test No. :	020606-1	Test Date :	06/06/02
Sampling Location :	On roof of chamber		
Sampling Train :	Mod. PM5.1 TR#2A	Input by :	Bill Welch

SOURCE TEST CALCULATIONS (VELOCITY)

SUMMARY

Stack Diameter: 12.0 in — Nozzle Diameter: 0.2499 in

A. Average Traverse Velocity............ 42.898 fps
B. Gas Meter Temperature (Use 60 °F for Temp Comp. Meters............ 91.8 °F
C. Gas Meter Correction Factor............ 0.9843

D. Average Stack Temp. :	136.6 °F	J. Sampling Time :	72 min
E. Stack Cross Sect. Area :	1.00 ft^2	K. Nozzle Cross Sect. Area :	0.000341 ft^2
F. Barometric Pressure :	28.9 in HgA	L. Net Sample Collection :	19.1 mg
G. Gas Meter Pressure :	29.01 in HgA	M. Net Solid Collection :	12.1 mg
H. Total Stack Pressure :	28.84 in HgA	N Water Vapor Condensed :	16.3 ml
I. Pitot Correction Factor :	0.84	O. Gas Volume Metered :	45.126 dcf

P. Corrected Gas Volume [(O x G/ 29.92) x 520/ (460 + B) x C]............ 40.583 dscf

PERCENT MOISTURE DENSITY

Q, Percent Water Vapor in Gas Sample [(4.64 x N)/ ((0.0464 x N) + P)]............ 1.65 %

R. Average Molecular Weight (Wet):

Component	Vol. Fract.	x Moisture fract.	x Molecular Wt.	= Wt/ Mole
Water	0.0165	1.00	18	0.297
Carbon Dioxide	0.0025 (dry basis)	0.98	44	0.108
Carbon Monoxide	6.3E-06 (dry basis)	0.98	28	0.000
Oxygen	0.209 (dry basis)	0.98	32	6.578
Nitrogen & Inerts	0.772 (dry basis)	0.98	28.2	21.412
				SUM = 28.395

FLOW RATE

S. Gas Density Correction Factor [(28.95/ R)^5]............ 1.010
T. Velocity Pressure Correction Factor [(29.92/ H)^5]............ 1.019
U. Corrected Velocity [A x I x S x T]............ 37.06 fps
V. Flow Rate [U x E x 60]............ 2223.54 cfm
W. Flow Rate (Standard) [V x (H/ 29.92) x (520/ (460 + D))]............ 1868.22 scfm
AA. Flow Rate (Dry Standard) [W x (1 - Q/ 100)]............ 1837.43 dscfm

SAMPLING CONCENTRATION/ EMISSION RATE

BB. Sample Concentration [0.01543 x (L/ P)]............ 0.007 gr/ dscf
CC. Sample Concentration [54,143 x (BB/ NA (molecular Wt.))]............ 3.93 ppm (dry)
DD. Sample Emission Rate [0.00857 x AA x BB]............ 0.114 lb/ hr
EE. Solid Emission Rate [(0.0001322 x M x AA)/ P]............ 0.072 lb/ hr
FF. Isokinetic Sampling Rate [(E x P x 100)/ (J x K x AA)]............ 90.1 %

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Test No. :	020606-1	Test Date :	06/06/02
Sampling Location :	On roof of chamber		
Sampling Train :	Mod. PM5.1 TR#2A	Input by :	Bill Welch

PM 5.1 CALCULATIONS

LAB ANALYSIS

Moisture Gain:	16.3	g
Organic Extract:	7	mg
Insoluable:	2.9	mg
Soluable:	5.7	mg
Filter	3.5	mg

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CE-CERT

Test No. :	020606-1	Test Date :	06/06/02
Sampling Location :	On roof of chamber		
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K* Determination

Pre-Test

Orifice del-h (in-Hg)	Volume final (ft^3)	Volume initial (ft^3)	Time (s)	K*
2.6	303.500	302.500	67.95	0.5476
1.9	305.000	304.000	79.15	0.5500
1.0	307.000	306.000	106.26	0.5647
			Average:	0.5541

Post-Test

Orifice del-h (in-Hg)	Volume final (ft^3)	Volume initial (ft^3)	Time (s)	K*
2.6	395.000	394.000	67.54	0.5509
1.9	396.500	395.500	78.74	0.5528
1.0	399.000	398.000	105.85	0.5668
			Average:	0.5569

Average K* for experiment: 0.5555

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CE-CERT

Test No. :	020606-1	Test Date :	06/06/02
Sampling Location :	On roof of chamber		
Sampling Train :	Mod. PM5.1 TR#2A	Input by :	Bill Welch

Summary of Results

Type of meat:	1/4 lb hamburger
Weight per unit meat:	0.250 lb
# units per load:	5
time (min) per load:	1 min
pounds meat cooked/hour:	75.05 lb/hr

Compound Name	Average Concentration
CO	6.3 ppm
CO_2	0.25 %
THC	10.6 ppm
CH_4	6.9 ppm

NMHC:	3.70 ppm
NMHC corrected for oxygenates:	4.04 ppm

Sample emission rates

uncorrected TNMHC	0.20 lb/1000lb meat
CO	6.30 ppm
CO_2	0.25 ppm
CO conc. based on 1500 dscfm flow	7.72 ppm
CO_2 concentration based on 1500 dscfm flow	0.31 ppm
TNMHC	0.22 lb/1000lb meat
Sample Emission Rate	1.52 lb/1000lb meat

UNIVERSITY OF CALIFORNIA, RIVERSIDE

CE-CERT

Test No. :	020606-1	Test Date :	06/06/02
Sampling Location :	On roof of chamber		
Sampling Train :	Mod. PM5.1 TR#2A	Input by :	Bill Welch

DNPH Analysis

Start Time:	13:48	initial volume:	580.168 scf
End Time:	14:48	final volume:	580.732 scf
Total Sampling Time (min):	60.0		
		Volume Sampled:	0.564 scf
Total Volume Sampled:	15.97 L		
Sampling Rate :	0.266 L/min		

Aldehydes:

Compound Name	mass recovered (ug) Cartridge A	mass recovered (ug) Cartridge B	mass recovered (ug) Cartridge C	Ave MW (g/mol)	Carbon Number	Total ppm
Formaldehyde	0.45	0.27	0.11	30.03	1	0.039
Acetaldehyde	1.70	0.12	0.05	44.05	2	0.060
Acrolein	0.02	0.00	0.01	56.06	3	0.001
Propionaldehyde	0.55	0.03	0.01	58.08	3	0.014
Crotonaldehyde	0.03	0.00	0.01	70.09	4	0.001
Methacrolein	0.00	0.00	0.00	70.09	4	0.000
Butyraldehyde	0.42	0.00	0.00	72.10	4	0.008
Benzaldehyde	0.04	0.11	0.12	106.12	7	0.004
Valeraldehyde	0.33	0.01	0.03	86.13	5	0.006
Tolualdehyde	0.00	0.01	0.00	120.14	8	0.000
Hexaldehyde	0.32	0.04	0.04	100.16	6	0.006

Total ppm	0.139
average carbon number :	2.381
FID (ppm):	0.332
Corrected FID (ppm):	**0.447**

Ketones:

Compound Name	mass recovered (ug) Cartridge A	mass recovered (ug) Cartridge B	mass recovered (ug) Cartridge C	Ave MW (g/mol)	Carbon Number	Total ppm
Acetone	1.59	0.75	0.41	58.08	3	0.067
2-Butanone	0.28	0.07	0.04	72.10	4	0.008

Total ppm	0.075
average carbon number:	3.103
FID (ppm):	0.232
Corrected FID (ppm):	**0.461**

UNIVERSITY OF CALIFORNIA, RIVERSIDE
CE-CERT

Test No. : 020606-1 Test Date : 06/06/02
Sampling Location : CE-CERT Test Kitchen
Input by : Bill Welch

Meat Summary

Number on Tray: 16
Run Number: 020606-1
Meat: 1/4 lb hamburger

# patties in tray	tray (kg)	raw + tray (kg)	cooked + tray (kg)	Wt. Loss (%)	Int. Meat Temp (°F)	Average (lb./patty)
16	1.474	3.299	2.791	27.8	165.2	0.251
16	1.475	3.293	2.828	25.6	161	0.250
16	1.501	3.316	2.841	26.2	161.3	0.250

Average Internal Meat Temperature: **162.5** °F
Average % Weight Loss: **26.5** %
Average weight, uncooked, lbs.: **0.250** lbs

UNIVERSITY OF CALIFORNIA, RIVERSIDE
CE-CERT

Test No. :	020607-1	Test Date :	06/07/2002
Sampling Location :	On roof of chamber		
Sampling Train :	Mod. PM5.1 TR#2A	Input by :	Bill Welch

SOURCE TEST CALCULATIONS (VELOCITY)

Pre-test Velocity Leak Check:	OK	Post-Test Velocity Leak Check:	OK
Stack Diameter:	12.0 in	Gas Meter Correction Factor:	0.9843
Nozzle Diameter:	0.2499 in	Pitot Factor:	0.840
Nozzle Cross Area:	0.000341 ft^2	K Factor:	0.5560
Barometric Pressure:	28.92 in-Hg	% of Moisture:	2.00
Static Pressure in Stack:	-0.8 in-water	Sampling Time:	72 min

Time (min)	Traverse Point	Gas Meter Reading	Vel. Head (" water)	Temp. (°F)	Calc. Vel (fps)	Sampling Rate (cfm)	Theo. Orif P (" water)	Act. Orif P (" water)	Meter Temp. In (°F)	Meter Temp. Out (°F)
		399.318								
6	1	402.8	0.34	142	41.49	0.602	1.26	1.17	80	79
12	2	406.45	0.36	141	42.66	0.620	1.34	1.29	81	79
18	3	410.1	0.36	141	42.66	0.620	1.35	1.30	84	80
24	4	413.699	0.34	141	41.45	0.602	1.28	1.27	86	81
30	5	417.7	0.46	145	48.38	0.698	1.73	1.58	87	82
36	6	423	0.49	142	49.81	0.722	1.86	2.78	89	83
42	7	426.3	0.46	138	48.10	0.702	1.77	1.08	91	84
48	8	430.428	0.43	136	46.43	0.680	1.66	1.70	92	84
54	9	434.05	0.34	136	41.28	0.605	1.31	1.31	91	85
60	10	437.9	0.40	136	44.78	0.656	1.55	1.48	91	86
66	11	442.7	0.38	138	43.72	0.638	1.47	2.30	91	86
72	12	445.525	0.36	134	42.41	0.623	1.40	0.80	92	86
Net Volume		46.207								
Average			0.393	139.167	44.429	0.647	1.498	1.506	87.917	82.917
								Average	85.4 °F	

UNIVERSITY OF CALIFORNIA, RIVERSIDE
CE-CERT

Test No. :	020607-1	Test Date :	06/07/02
Sampling Location :	On roof of chamber		
Sampling Train :	Mod. PM5.1 TR#2A	Input by :	Bill Welch

SOURCE TEST CALCULATIONS (VELOCITY)

SUMMARY

Stack Diameter: 12.0 in — Nozzle Diameter: 0.2499 in

A. Average Traverse Velocity.......... 44.429 fps
B. Gas Meter Temperature (Use 60 °F for Temp Comp. Meters.......... 85.4 °F
C. Gas Meter Correction Factor.......... 0.9843

D. Average Stack Temp. :	139.2 °F	J. Sampling Time :	72 min
E. Stack Cross Sect. Area :	1.00 ft^2	K. Nozzle Cross Sect. Area :	0.000341 ft^2
F. Barometric Pressure :	28.92 in HgA	L. Net Sample Collection :	15 mg
G. Gas Meter Pressure :	29.03 in HgA	M. Net Solid Collection :	10.2 mg
H. Total Stack Pressure :	28.86 in HgA	N Water Vapor Condensed :	21.2 ml
I. Pitot Correction Factor :	0.84	O. Gas Volume Metered :	46.207 dcf

P. Corrected Gas Volume [(O x G/ 29.92) x 520/ (460 + B) x C].......... 42.073 dscf

PERCENT MOISTURE DENSITY

Q, Percent Water Vapor in Gas Sample [(4.64 x N)/ ((0.0464 x N) + P)].......... 2.08 %

R. Average Molecular Weight (Wet):

Component	Vol. Fract.	x Moisture fract.	x Molecular Wt.	= Wt/ Mole
Water	0.0208	1.00	18	0.375
Carbon Dioxide	0.0022 (dry basis)	0.98	44	0.095
Carbon Monoxide	2.6E-06 (dry basis)	0.98	28	0.000
Oxygen	0.209 (dry basis)	0.98	32	6.549
Nitrogen & Inerts	0.768 (dry basis)	0.98	28.2	21.205
				SUM = 28.223

FLOW RATE

S. Gas Density Correction Factor [(28.95/ R)^5].......... 1.013
T. Velocity Pressure Correction Factor [(29.92/ H)^5].......... 1.018
U. Corrected Velocity [A x I x S x T].......... 38.48 fps
V. Flow Rate [U x E x 60].......... 2309.09 cfm
W. Flow Rate (Standard) [V x (H/ 29.92) x (520/ (460 + D))].......... 1933.07 scfm
AA. Flow Rate (Dry Standard) [W x (1 - Q/ 100)].......... 1892.78 dscfm

SAMPLING CONCENTRATION/ EMISSION RATE

BB. Sample Concentration [0.01543 x (L/ P)].......... 0.006 gr/ dscf
CC. Sample Concentration [54,143 x (BB/ NA (molecular Wt.))].......... 2.98 ppm (dry)
DD. Sample Emission Rate [0.00857 x AA x BB].......... 0.089 lb/ hr
EE. Solid Emission Rate [(0.0001322 x M x AA)/ P].......... 0.061 lb/ hr
FF. Isokinetic Sampling Rate [(E x P x 100)/ (J x K x AA)].......... 90.6 %

UNIVERSITY OF CALIFORNIA, RIVERSIDE
CE-CERT

Test No. :	020607-1	Test Date :	06/07/02
Sampling Location :	On roof of chamber		
Sampling Train :	Mod. PM5.1 TR#2A	Input by :	Bill Welch

PM 5.1 CALCULATIONS

LAB ANALYSIS

Moisture Gain:	21.2	g
Organic Extract:	4.8	mg
Insoluable:	1	mg
Soluable:	5.8	mg
Filter	3.4	mg

UNIVERSITY OF CALIFORNIA, RIVERSIDE
CE-CERT

Test No. :	020607-1	Test Date :	06/07/02
Sampling Location :	On roof of chamber		
Sampling Train :	Mod. PM5.1 TR#2A	Input by :	Bill Welch

K* Determination

Pre-Test

Orifice del-h (in-Hg)	Volume final (ft^3)	Volume initial (ft^3)	Time (s)	K*
2.6	395.000	394.000	67.54	0.5509
1.9	396.500	395.500	78.74	0.5528
1.0	399.000	398.000	105.85	0.5668
			Average:	0.5569

Post-Test

Orifice del-h (in-Hg)	Volume final (ft^3)	Volume initial (ft^3)	Time (s)	K*
2.6	493.500	492.500	67.80	0.5488
1.9	495.000	494.000	79.01	0.5509
1.0	497.000	496.000	106.10	0.5655
			Average:	0.5551

Average K* for experiment: 0.5560

UNIVERSITY OF CALIFORNIA, RIVERSIDE
CE-CERT

Test No. :	020607-1	Test Date :	06/07/02
Sampling Location :	On roof of chamber		
Sampling Train :	Mod. PM5.1 TR#2A	Input by :	Bill Welch

Summary of Results

Type of meat:	1/4 lb hamburger
Weight per unit meat:	0.250 lb
# units per load:	5
time (min) per load:	1 min
pounds meat cooked/hour:	74.98 lb/hr

Compound Name	Average Concentration
CO	2.6 ppm
CO_2	0.22 %
THC	10.8 ppm
CH_4	8.2 ppm

NMHC:	2.60 ppm
NMHC corrected for oxygenates:	2.82 ppm

Sample emission rates

uncorrected TNMHC	0.15 lb/1000lb meat
CO	2.60 ppm
CO_2	0.22 ppm
CO conc. based on 1500 dscfm flow	3.28 ppm
CO_2 concentration based on 1500 dscfm flow	0.28 ppm
TNMHC	0.16 lb/1000lb meat
Sample Emission Rate	1.19 lb/1000lb meat

UNIVERSITY OF CALIFORNIA, RIVERSIDE
CE-CERT

Test No. :	020607-1	Test Date :	06/07/02
Sampling Location :	On roof of chamber		
Sampling Train :	Mod. PM5.1 TR#2A	Input by :	Bill Welch

DNPH Analysis

Start Time:	13:48	initial volume:	581.538 scf
End Time:	14:48	final volume:	582.399 scf
Total Sampling Time (min):	60.0		
		Volume Sampled:	0.861 scf
Total Volume Sampled:	24.38 L		
Sampling Rate :	0.406 L/min		

Aldehydes:

Compound Name	mass recovered (ug) Cartridge A	mass recovered (ug) Cartridge B	mass recovered (ug) Cartridge C	Ave MW (g/mol)	Carbon Number	Total ppm
Formaldehyde	0.38	0.21	0.00	30.03	1	0.018
Acetaldehyde	2.04	0.07	0.00	44.05	2	0.044
Acrolein	0.03	0.00	0.00	56.06	3	0.001
Propionaldehyde	0.66	0.03	0.00	58.08	3	0.011
Crotonaldehyde	0.03	0.01	0.00	70.09	4	0.000
Methacrolein	0.00	0.00	0.00	70.09	4	0.000
Butyraldehyde	0.51	0.00	0.00	72.10	4	0.007
Benzaldehyde	0.00	0.19	0.00	106.12	7	0.002
Valeraldehyde	0.38	0.01	0.00	86.13	5	0.004
Tolualdehyde	0.00	0.01	0.00	120.14	8	0.000
Hexaldehyde	0.39	0.06	0.00	100.16	6	0.004
					Total ppm	0.091
					average carbon number :	2.498
					FID (ppm):	0.228
					Corrected FID (ppm):	**0.307**

Ketones:

Compound Name	mass recovered (ug) Cartridge A	mass recovered (ug) Cartridge B	mass recovered (ug) Cartridge C	Ave MW (g/mol)	Carbon Number	Total ppm
Acetone	1.70	0.85	0.00	58.08	3	0.041
2-Butanone	0.27	0.08	0.00	72.10	4	0.005
					Total ppm	0.045
					average carbon number:	3.101
					FID (ppm):	0.140
					Corrected FID (ppm):	**0.279**

UNIVERSITY OF CALIFORNIA, RIVERSIDE
CE-CERT

Test No. : 020607-1 Test Date : 06/07/02
Sampling Location : CE-CERT Test Kitchen
Input by : Bill Welch

Meat Summary

Number on Tray: 16
Run Number: 020607-1
Meat: 1/4 lb hamburger

# patties in tray	tray (kg)	raw + tray (kg)	cooked + tray (kg)	Wt. Loss (%)	Int. Meat Temp (°F)	Average (lb./patty)
16	1.477	3.294	2.688	33.4	169.1	0.250
16	1.502	3.317	2.809	28.0	162.6	0.250
16	1.475	3.296	2.756	29.7	162.5	0.250

Average Internal Meat Temperature: **164.7** °F
Average % Weight Loss: **30.3** %
Average weight, uncooked, lbs.: **0.250** lbs

UNIVERSITY OF CALIFORNIA, RIVERSIDE
CE-CERT

Test No. :	020607-2	Test Date :	06/07/2002
Sampling Location :	On roof of chamber		
Sampling Train :	Mod. PM5.1 TR#2A	Input by :	Bill Welch

SOURCE TEST CALCULATIONS (VELOCITY)

Pre-test Velocity Leak Check:	OK	Post-Test Velocity Leak Check:	OK
Stack Diameter:	12.0 in	Gas Meter Correction Factor:	0.9843
Nozzle Diameter:	0.2499 in	Pitot Factor:	0.840
Nozzle Cross Area:	0.000341 ft^2	K Factor:	0.5560
Barometric Pressure:	28.92 in-Hg	% of Moisture:	2.00
Static Pressure in Stack:	-0.8 in-water	Sampling Time:	72 min

Time (min)	Traverse Point	Gas Meter Reading	Vel. Head (" water)	Temp. (°F)	Calc. Vel (fps)	Sampling Rate (cfm)	Theo. Orif P (" water)	Act. Orif P (" water)	Meter Temp. In (°F)	Meter Temp. Out (°F)
		445.829								
6	1	449.5	0.34	141	41.45	0.602	1.27	1.31	82	81
12	2	453.2	0.35	139	41.99	0.612	1.32	1.34	84	82
18	3	456.8	0.37	138	43.14	0.630	1.41	1.28	87	83
24	4	460.721	0.36	136	42.48	0.622	1.38	1.52	87	83
30	5	464.8	0.47	137	48.58	0.710	1.81	1.66	90	85
36	6	469.05	0.49	137	49.60	0.725	1.90	1.81	92	86
42	7	473.1	0.41	132	45.18	0.666	1.61	1.65	94	86
48	8	476.952	0.37	131	42.88	0.633	1.46	1.49	94	87
54	9	480.5	0.33	131	40.50	0.598	1.30	1.27	94	88
60	10	484.2	0.38	135	43.61	0.640	1.49	1.38	94	88
66	11	487.95	0.39	133	44.10	0.649	1.53	1.42	95	88
72	12	491.541	0.32	133	39.95	0.588	1.26	1.31	95	90
Net Volume		45.712								
Average			0.382	135.250	43.622	0.640	1.478	1.454	90.667	85.583
								Average	88.1 °F	

UNIVERSITY OF CALIFORNIA, RIVERSIDE
CE-CERT

Test No. :	020607-2	Test Date :	06/07/02
Sampling Location :	On roof of chamber		
Sampling Train :	Mod. PM5.1 TR#2A	Input by :	Bill Welch

SOURCE TEST CALCULATIONS (VELOCITY)

SUMMARY

Stack Diameter: 12.0 in   Nozzle Diameter: 0.2499 in

A. Average Traverse Velocity	43.622	fps
B. Gas Meter Temperature (Use 60 °F for Temp Comp. Meters	88.1	°F
C. Gas Meter Correction Factor	0.9843	

D. Average Stack Temp. :	135.3	°F	J. Sampling Time :	72	min
E. Stack Cross Sect. Area :	1.00	ft^2	K. Nozzle Cross Sect. Area :	0.000341	ft^2
F. Barometric Pressure :	28.92	in HgA	L. Net Sample Collection :	14.6	mg
G. Gas Meter Pressure :	29.03	in HgA	M. Net Solid Collection :	9.5	mg
H. Total Stack Pressure :	28.86	in HgA	N Water Vapor Condensed :	18.4	ml
I. Pitot Correction Factor :	0.84		O. Gas Volume Metered :	45.712	dcf

P. Corrected Gas Volume [(O x G/ 29.92) x 520/ (460 + B) x C]	41.411	dscf

PERCENT MOISTURE DENSITY

Q, Percent Water Vapor in Gas Sample [(4.64 x N)/ ((0.0464 x N) + P)]	1.83	%

R. Average Molecular Weight (Wet):

Component	Vol. Fract.	x	Moisture fract.	x	Molecular Wt.	=	Wt/ Mole
Water	0.0183		1.00		18		0.330
Carbon Dioxide	0.002 (dry basis)		0.98		44		0.086
Carbon Monoxide	1.6E-06 (dry basis)		0.98		28		0.000
Oxygen	0.209 (dry basis)		0.98		32		6.565
Nitrogen & Inerts	0.771 (dry basis)		0.98		28.2		21.334
						SUM =	28.316

FLOW RATE

S. Gas Density Correction Factor [(28.95/ R)^5]	1.011	
T. Velocity Pressure Correction Factor [(29.92/ H)^5]	1.018	
U. Corrected Velocity [A x I x S x T]	37.72	fps
V. Flow Rate [U x E x 60]	2263.41	cfm
W. Flow Rate (Standard) [V x (H/ 29.92) x (520/ (460 + D))]	1907.30	scfm
AA. Flow Rate (Dry Standard) [W x (1 - Q/ 100)]	1872.33	dscfm

SAMPLING CONCENTRATION/ EMISSION RATE

BB. Sample Concentration [0.01543 x (L/ P)]	0.005	gr/ dscf
CC. Sample Concentration [54,143 x (BB/ NA (molecular Wt.))]	2.95	ppm (dry)
DD. Sample Emission Rate [0.00857 x AA x BB]	0.087	lb/ hr
EE. Solid Emission Rate [(0.0001322 x M x AA)/ P]	0.057	lb/ hr
FF. Isokinetic Sampling Rate [(E x P x 100)/ (J x K x AA)]	90.2	%

UNIVERSITY OF CALIFORNIA, RIVERSIDE

CE-CERT

Test No. :	020607-2	Test Date :	06/07/02
Sampling Location :	On roof of chamber		
Sampling Train :	Mod. PM5.1 TR#2A	Input by :	Bill Welch

PM 5.1 CALCULATIONS

LAB ANALYSIS

Moisture Gain:	18.4	g
Organic Extract:	5.1	mg
Insoluable:	0	mg
Soluable:	6.2	mg
Filter	3.3	mg

UNIVERSITY OF CALIFORNIA, RIVERSIDE
CE-CERT

Test No. :	020607-2	Test Date :	06/07/02
Sampling Location :	On roof of chamber		
Sampling Train :	Mod. PM5.1 TR#2A	Input by :	Bill Welch

K* Determination

Pre-Test

Orifice del-h (in-Hg)	Volume final (ft^3)	Volume initial (ft^3)	Time (s)	K*
2.6	395.000	394.000	67.54	0.5509
1.9	396.500	395.500	78.74	0.5528
1.0	399.000	398.000	105.85	0.5668
			Average:	0.5569

Post-Test

Orifice del-h (in-Hg)	Volume final (ft^3)	Volume initial (ft^3)	Time (s)	K*
2.6	493.500	492.500	67.80	0.5488
1.9	495.000	494.000	79.01	0.5509
1.0	497.000	496.000	106.10	0.5655
			Average:	0.5551

Average K* for experiment: 0.5560

UNIVERSITY OF CALIFORNIA, RIVERSIDE
CE-CERT

Test No. :	020607-2	Test Date :	06/07/02
Sampling Location :	On roof of chamber		
Sampling Train :	Mod. PM5.1 TR#2A	Input by :	Bill Welch

Summary of Results

Type of meat:	1/4 lb hamburger
Weight per unit meat:	0.251 lb
# units per load:	5
time (min) per load:	1 min
pounds meat cooked/hour:	75.16 lb/hr

Compound Name	Average Concentration
CO	1.6 ppm
CO_2	0.2 %
THC	11.6 ppm
CH_4	8.5 ppm

NMHC:	3.10 ppm
NMHC corrected for oxygenates:	3.36 ppm

Sample emission rates

uncorrected TNMHC	0.17 lb/1000lb meat
CO	1.60 ppm
CO_2	0.20 ppm
CO conc. based on 1500 dscfm flow	2.00 ppm
CO_2 concentration based on 1500 dscfm flow	0.25 ppm
TNMHC	0.19 lb/1000lb meat
Sample Emission Rate	1.16 lb/1000lb meat

UNIVERSITY OF CALIFORNIA, RIVERSIDE
CE-CERT

Test No. :	020607-2	Test Date :	06/07/02
Sampling Location :	On roof of chamber		
Sampling Train :	Mod. PM5.1 TR#2A	Input by :	Bill Welch

DNPH Analysis

Start Time:	13:48	initial volume:	582.399 scf
End Time:	14:48	final volume:	583.079 scf
Total Sampling Time (min):	60.0		
		Volume Sampled:	0.68 scf
Total Volume Sampled:	19.25 L		
Sampling Rate :	0.321 L/min		

Aldehydes:

Compound Name	mass recovered (ug) Cartridge A	mass recovered (ug) Cartridge B	mass recovered (ug) Cartridge C	Ave MW (g/mol)	Carbon Number	Total ppm
Formaldehyde	0.52	0.34	0.12	30.03	1	0.038
Acetaldehyde	1.37	0.18	0.06	44.05	2	0.043
Acrolein	0.02	0.00	0.01	56.06	3	0.000
Propionaldehyde	0.44	0.04	0.02	58.08	3	0.010
Crotonaldehyde	0.02	0.00	0.01	70.09	4	0.000
Methacrolein	0.00	0.00	0.00	70.09	4	0.000
Butyraldehyde	0.32	0.01	0.00	72.10	4	0.005
Benzaldehyde	0.07	0.04	0.13	106.12	7	0.003
Valeraldehyde	0.29	0.01	0.03	86.13	5	0.004
Tolualdehyde	0.00	0.00	0.00	120.14	8	0.000
Hexaldehyde	0.26	0.02	0.04	100.16	6	0.004

Total ppm	0.108
average carbon number :	2.234
FID (ppm):	0.241
Corrected FID (ppm):	**0.325**

Ketones:

Compound Name	mass recovered (ug) Cartridge A	mass recovered (ug) Cartridge B	mass recovered (ug) Cartridge C	Ave MW (g/mol)	Carbon Number	Total ppm
Acetone	1.48	0.66	0.40	58.08	3	0.051
2-Butanone	0.29	0.06	0.04	72.10	4	0.006

Total ppm	0.057
average carbon number:	3.109
FID (ppm):	0.179
Corrected FID (ppm):	**0.354**

UNIVERSITY OF CALIFORNIA, RIVERSIDE
CE-CERT

Test No. : 020607-2 Test Date : 06/07/02
Sampling Location : CE-CERT Test Kitchen
Input by : Bill Welch

Meat Summary

Number on Tray: 16
Run Number: 020607-2
Meat: 1/4 lb hamburger

# patties in tray	tray (kg)	raw + tray (kg)	cooked + tray (kg)	Wt. Loss (%)	Int. Meat Temp (°F)	Average (lb./patty)
16	1.499	3.316	2.792	28.8	160.1	0.250
16	1.474	3.297	2.799	27.3	161.4	0.251
16	1.475	3.301	2.766	29.3	162.1	0.251

Average Internal Meat Temperature: **161.2** °F
Average % Weight Loss: **28.5** %
Average weight, uncooked, lbs.: **0.251** lbs

APPENDIX B

Source Test Analytical Data

TEST NO.:	**02-0606-15**	Start Date:	06/06/2002
		Completion Date:	07/17/2002
Silica Gel (% pink) =	90%	Report:	07/17/2002

Filter Tare Wt. (g) = 0.1241

Placed in Dessicator:

Date	Time	Weight	Date	Time	Weight
06/07/2002	12:45	0.1275			
06/10/2002	8:35	0.1276			

Filter Net Gain (mg): 3.5

Impingers

	Content	Tare Wt. (g)	Final Wt. (g)	Net (g)
1	Empty	512.56	517.35	4.79
2	100 mL H2O	619.60	620.42	0.82
3	100 mL H2O	615.75	615.41	-0.34
4	Empty	512.90	513.72	0.82
5	Silica Gel	694.45	704.65	10.20

Impinger Gain (g): 6.1

Silica Gel Gain (g): 10.2

Impinger Recovery:

MeCl2 volume (mL): 300

H2O volume (mL): 600

Insoluble Filter Tare Wt. (g) = 0.127

Placed in Dessicator:

Date	Time	Weight
07/10/2002	15:40	0.1299
07/11/2002	14:30	0.1299

Filter Net Gain (mg): 2.9

Impinger Catch Extract Tare Wt.(g) = 67.9307 **Impinger Catch** Tare Wt (g) = 67.8231

Date	Time	Weight	Date	Time	Weight
07/12/2002	8:10	67.9368	07/15/2002	16:20	67.8293
07/15/2002	16:10	67.9380	07/16/2002	11:58	67.8286
07/16/2002	11:58	67.9377	07/17/2002	15:00	67.8288

Organic Net Gain (mg): 7.0 **Inorganic Net Gain (mg): 5.7**

TEST NO.: **02-0607-15**

Start Date: 06/07/2002
Completion Date: 07/15/2002
Report: 07/17/2002

Silica Gel (% pink) = 60%

Filter Tare Wt. (g) = 0.1263

Placed in Dessicator:

Date	Time	Weight	Date	Time	Weight
06/10/2002	8:35	0.1306			
06/11/2002	10:30	0.1297			
06/12/2002	12:35	0.1297			

Filter Net Gain (mg): **3.4**

Impingers

	Content	Tare Wt. (g)	Final Wt. (g)	Net (g)
1	Empty	512.51	520.06	7.55
2	100 mL H2O	620.50	623.03	2.53
3	100 mL H2O	615.77	615.99	0.22
4	Empty	512.76	514.06	1.30
5	Silica Gel	698.80	708.43	9.63

Impinger Gain (g): **11.6**

Silica Gel Gain (g): **9.6**

Impinger Recovery:

MeCl2 volume (mL): 300

H2O volume (mL): 600

Insoluble Filter Tare Wt. (g) = 0.1248

Placed in Dessicator:

Date	Time	Weight
07/08/2002	16:40	0.1257
07/10/2002	15:40	0.1258

Filter Net Gain (mg): **1.0**

Impinger Catch Extract Tare Wt.(g) = 67.6978

Date	Time	Weight
07/10/2002	15:15	67.7028
07/11/2002	14:00	67.7026

Organic Net Gain (mg): **4.8**

Impinger Catch Tare Wt (g) = 67.8845

Date	Time	Weight
07/12/2002	8:10	67.8895
07/15/2002	16:05	67.8905
07/15/2002	23:58	67.8903

Inorganic Net Gain (mg): **5.8**

TEST NO.: **02-0607-25**

Start Date: 06/07/2002
Completion Date: 07/16/2002
Report: 07/17/2002

Silica Gel (% pink) = 70%

Filter Tare Wt. (g) = 0.1235

Placed in Dessicator:

Date	Time	Weight	Date	Time	Weight
06/10/2002	8:35	0.1267			
06/11/2002	10:30	0.1268			

Filter Net Gain (mg):	**3.3**

Impingers

	Content	Tare Wt. (g)	Final Wt. (g)	Net (g)
1	Empty	513.72	520.47	6.75
2	100 mL H2O	620.05	622.55	2.50
3	100 mL H2O	616.02	615.33	-0.69
4	Empty	511.60	512.30	0.70
5	Silica Gel	710.22	719.36	9.14

Impinger Gain (g):	**9.3**
Silica Gel Gain (g):	**9.1**

Impinger Recovery:

MeCl2 volume (mL):

H2O volume (mL):

Insoluble Filter Tare Wt. (g) = 0.1277

Placed in Dessicator:

Date	Time	Weight
07/10/2002	15:25	0.128
07/11/2002	14:31	0.128

Filter Net Gain (mg):	**<1mg**

Impinger Catch Extract Tare Wt.(g) = 67.5012 **Impinger Catch** Tare Wt (g) = 67.3811

Date	Time	Weight	Date	Time	Weight
07/12/2002	8:30	67.5053	07/15/2002	16:25	67.3876
07/15/2002	16:06	67.5066	07/16/2002	11:59	67.3873
07/16/2002	11:58	67.5063			

Organic Net Gain (mg):	**5.1**	**Inorganic Net Gain (mg):**	**6.2**